

ALBERTA IN THE GLOBAL ENERGY SPECTRUM

Alberta

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Statistics are based on information provided by the Energy Resources Conservation Board, unless otherwise indicated.



With its abundance of oil, natural gas and coal, Alberta is Canada's energy province. Underlying its prairies, forests and mountains is the resource-rich Western Canadian Sedimentary Basin. Although this basin was tapped to a limited degree early this century, it was a major oil discovery at Leduc in 1947 that touched off an oil and gas development boom that transformed primarily agricultural Alberta into the dynamic and technologically advanced province it is today.

Stretching eastward from the Rocky Mountains, Alberta covers more than 661,000 square kilometres, an area larger than France. Its population has more than tripled since the Leduc discovery and now stands at 2.4 million. More than half the population lives in the two largest cities - Edmonton, the

provincial capital, and Calgary, a financial centre and headquarters for more than 700 energy and resource companies.

Alberta produces 80 per cent of Canada's conventional oil, 86 per cent of its natural gas and 38 per cent of its coal. In addition to its conventional oil resources, Alberta also has vast reserves of heavy oil and oil sands. The heavy oil and oil sands are being developed to augment conventional oil production - and currently account for all of Canada's production from oil sands.

Thanks to Alberta's energy resources, Canada stands among the world's top-10 oil producers, is a net exporter of oil, and is 16th in terms of conventional world oil reserves. Canada's gas production accounts for about five per cent of the world total,

Pumping jack: familiar sight on the Alberta landscape.

while its proven gas reserves, more than 90 per cent of them in Alberta, represent about 2.5 per cent of the world figure. Although it produces less than 10 per cent of the total world coal output, Canada ranks third in coal exports. Alberta sulphur accounts for approximately 45 per cent of the world's sulphur trade.

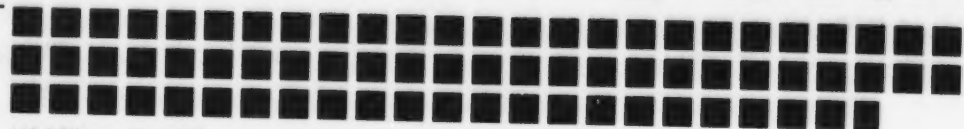
This booklet provides an overview of Alberta's energy resources. It outlines the provincial government's approach to development of these resources, briefly describes the roles of various government departments and agencies, and summarizes Alberta's international energy-related activities.

Energy Reserves

Alberta In Comparison - 1988

World Canada Alberta

Oil
(Conventional,
Oil Sands,
Heavy Oil)



145.7 Billion cubic metres



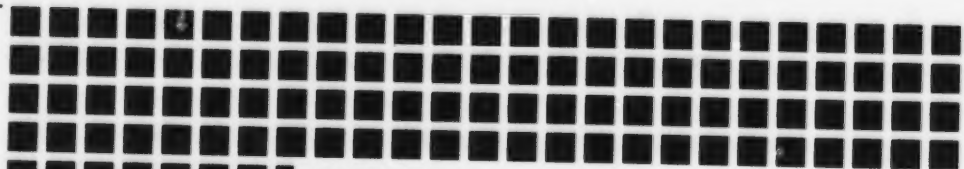
49.4 Billion cubic metres



48.7 Billion cubic metres

■ = 2 Billion cubic metres

Gas



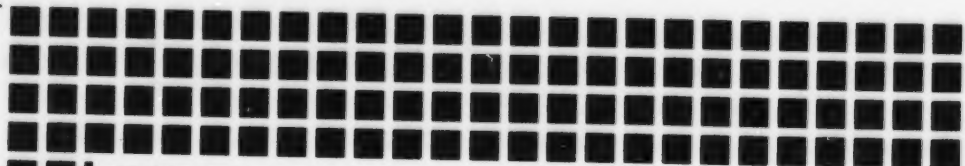
107.6 Trillion cubic metres

■ = 1 Trillion cubic metres

2.7 Trillion cubic metres

1.7 Trillion cubic metres

Coal



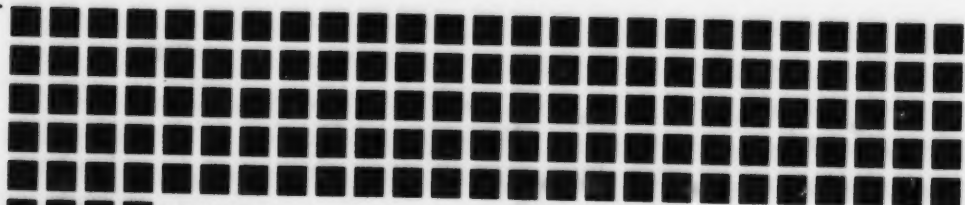
1,023 Billion tonnes

■ = 10 Billion tonnes

6.5 Billion tonnes

1.9 Billion tonnes

Sulphur



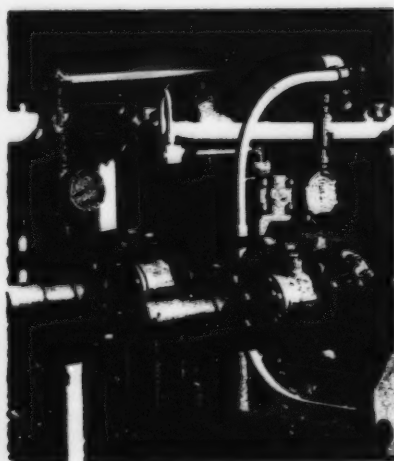
1,290 Million tonnes

■ = 10 Million tonnes

150 Million tonnes

101.7 Million tonnes

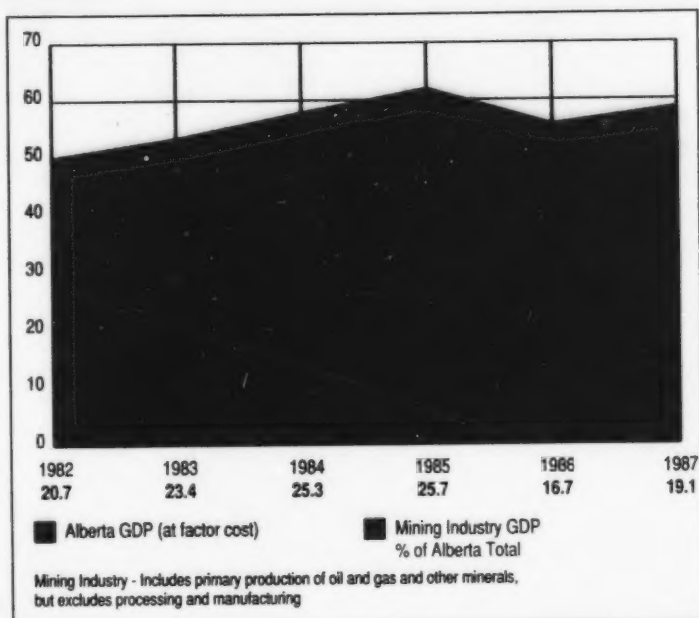
Because the province is so richly endowed with oil, gas, oil sands, heavy oil and coal, the energy sector plays a major role in the Alberta economy, accounting for about 16 per cent of the province's gross domestic product. Some 80,000 Albertans are directly employed in the energy industry and more than 700 oil and gas companies operate in the province. In 1988, government revenue from energy resources - royalties, rentals, fees, bonuses and sales of Crown leases - totalled more than \$2.7 billion, about 28 per cent of the government's overall revenue. The total value of Alberta's mineral production in the same year was \$16.4 billion, while energy investment in the province approached \$5.5 billion.



Valves at gas processing plant.

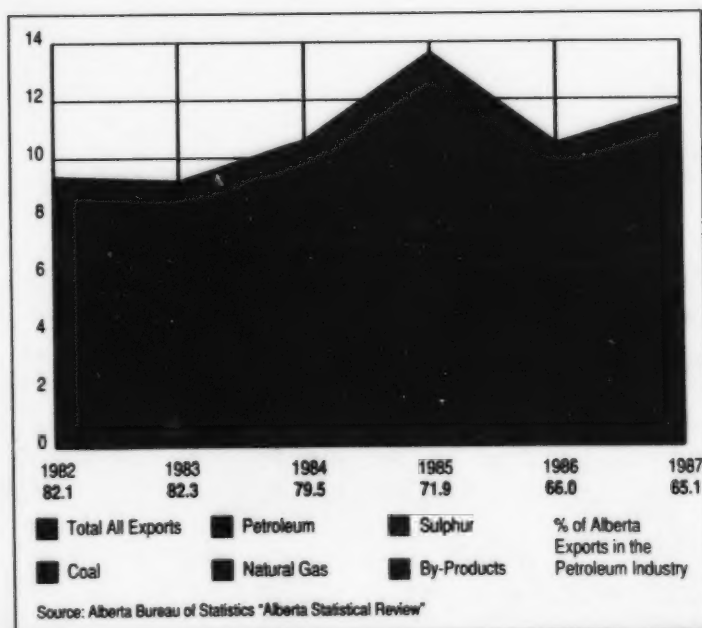
Importance of Petroleum Industry

GDP \$ Millions



Alberta Exports

\$ Billions

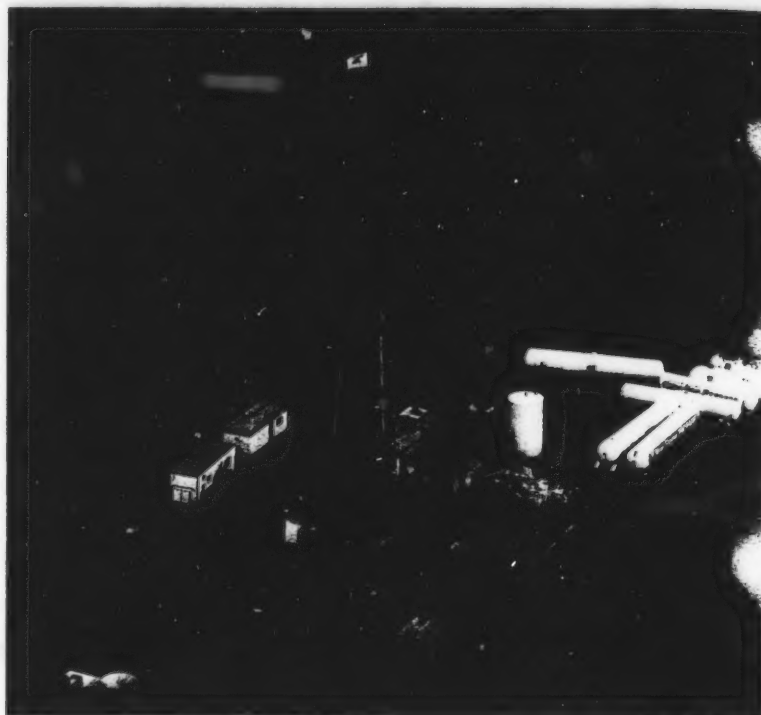


CRUDE OIL

Alberta has three kinds of oil resources which are classified by density:

1. Conventional crude oil, which is recovered through normal drilling operations;
2. Heavy oil, a thick viscous form of crude, only 10 per cent of which can be recovered without special recovery techniques such as steam stimulation;
3. Oil sands, a black, sticky combination of sand, clay, water and bitumen requiring non-conventional recovery operations. Bitumen is immobile at reservoir temperatures.

Together, heavy oil and oil sands production totals 79,500 m³ per day — or about one-third of Alberta's overall hydrocarbon liquids production.



CONVENTIONAL CRUDE

Alberta's remaining established reserves of conventional crude total 593 million m³, or 82 per cent of Canadian on-shore reserves. Production from conventional sources totalled 57.2 million m³ in 1988. As

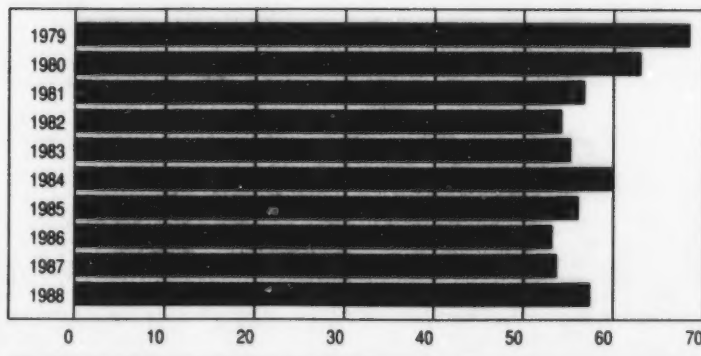
reserves decline, greater efforts are being made to improve production from existing reservoirs. Water injection, or secondary recovery, is the most common enhanced oil recovery (EOR) technique, but increased attention is being given to advanced or tertiary methods —

Drilling rig: the search continues.

such as miscible flood (injecting natural gas liquids which act as a solvent) — to recover additional oil. More than 45 EOR projects operating in Alberta in 1988 were credited with producing an additional 18.3 thousand m³/d.

Conventional Oil Production

Millions of cubic metres



HEAVY OIL

Heavy oil, having an API of less than 25 degrees (density greater than 904 kg/m³), is composed mainly of gas-oil, lube oil and asphaltenes - all high-density materials. Only a small percentage is recoverable by conventional means; thermal methods, used in the oil sands, are being employed to recover heavy oil. Heavy oil reserves in Alberta are estimated at 53 million m³, with the province's major fields located along Alberta's eastern border.

Currently, most heavy oil is exported to U.S. Midwest refineries, but the Alberta government also encourages the upgrading of heavy oil and bitumen resources in the province. A \$1.3 billion upgrader at Lloydminster, Alberta — jointly financed by Husky Oil Ltd. and the governments of Canada, Alberta and Saskatchewan — will make an additional 7,310 m³/d usable by Canadian refineries. The upgrader is scheduled to begin operations in 1992.

OIL SANDS

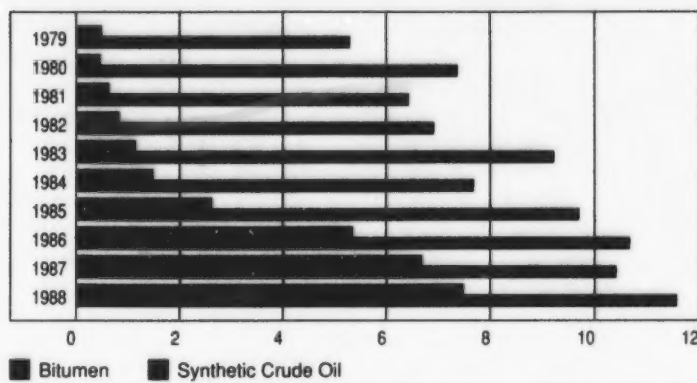
Alberta's oil sands extend from surface deposits to deposits at depths of 760 m or greater and are enormous, even by world standards. They represent more than 48 billion m³ of potentially recoverable bitumen or 97 per cent of Alberta's total petroleum resources. This is equivalent to more than one-third of the world's reserves of conventional crude oil.

The largest oil sands deposit is the Athabasca deposit, with an estimated 209 billion m³ of bitumen in place, followed by Cold Lake (35 billion m³) and Peace River (23 billion m³). About 10 per cent of the oil sands at Athabasca lie close enough to the surface to be mined, using draglines and bucketwheel excavators to collect the bitumen and then applying heat, water and chemicals to separate bitumen from the sands. Deeper oil sands deposits require in situ ("in place") recovery techniques, usually involving steam injection or underground combustion to reduce the viscosity of the bitumen so it can be pumped to the surface through conventional wells.

Billions of dollars have been invested to develop Alberta's oil

Bitumen and Synthetic Crude Oil Production

Millions of cubic metres



sands and heavy oil. An even greater investment — for new projects and expansion of existing plants — is planned or is underway. Here is a summary of existing and planned projects:

MINING

Suncor Inc. - Alberta's first commercial-scale, integrated oil sands plant (mining, extraction and upgrading) is located near Fort McMurray. Built at a cost of nearly \$250 million in the 1960s and now undergoing improvements totalling \$200 million, the Suncor plant will produce an average of 8,130 m³/d of synthetic crude when the improvements are completed.

Syncrude Canada Ltd. - The original cost of this huge integrated plant, which began operations in 1979, was \$2.1 billion. A recent \$685 million addition increased capacity to 24,760 m³/d of synthetic crude.

IN SITU

Esso Cold Lake - After 20 years of pilot study, Esso Resources Canada Limited began commercial operation of

its \$510 million steam injection plant near Cold Lake in 1985. Output in 1988 averaged in excess of 12,200 m³/d.

BP Canada Inc./Petro-Canada Wolf Lake - The two companies operate a \$100 million steam injection plant designed to produce 1,110 m³/d of bitumen. A \$210 million expansion program will increase production to 3,140 m³/d.

Shell Canada Limited Peace River - This \$185 million steam-drive project, which began operations in 1986, has a designed capacity of 1,590 m³/d of bitumen.

Future oil sands/heavy oil developments include the \$4.1 billion OSLO Alberta Oil Sands Project (involving a consortium of private companies and the Canadian and Alberta governments), which will produce 12,500 m³/d of synthetic crude when it begins operation in 1996 or 1997. Two major heavy oil upgraders are also planned, at Lloydminster and Shell's \$575 million upgrader in the Edmonton area (3,200 m³/d).

MARKETS FOR ALBERTA CRUDE OIL AND EQUIVALENT

Alberta crude oil and equivalent (conventional light and medium crude oil, synthetic crude, heavy crude and bitumen and pentanes plus) supply a number of markets. The Alberta market takes 22 per cent of the output, followed by export markets which account for 38 per cent, and Canada excluding Alberta with 40 per cent.

Within Canada, Ontario takes 25 per cent, Quebec and the Atlantic Provinces seven per cent, British Columbia six per cent and Saskatchewan and Manitoba two per cent.

U.S. refineries around Chicago and Minneapolis/St. Paul are the main export markets for Alberta crude, with more than half being heavy crude.

Alberta's six refineries process part of the province's conventional and synthetic crude oil production. Their crude oil and condensate capacity is almost 63,000 m³/d. Three of these refineries are designed to process primarily light and medium conventional crude oil. Two are world-class facilities which alone account for 75 per cent of Alberta's total refinery capacity.

Ontario refineries take primarily light crude and some synthetic. Light crudes predominate in the Montreal market and are the main export to B.C.

Three pipeline systems carry crude from Alberta to outside

markets. The Interprovincial Pipe Line Limited pipeline, with a capacity of 237,000 m³/d, consists of three lines extending east from Edmonton to Superior, Wisconsin — one carrying natural gas liquids, refined products and synthetics, another for light crudes and synthetics, and the third for light, medium and heavy crudes and condensates. At Superior, IPL becomes two lines, taking two routes to Samia, and from

Samia, one line runs to Montreal. The Trans Mountain Pipe Line runs west from Edmonton to a marine terminal at Burnaby, B.C. When expansion of this line is complete, it will have a capacity of 30,000 m³/d. The Rangeland Pipeline, with a capacity of 12,500 m³/d, carries light and heavy crudes south from Edmonton to four Montana refineries.



Province encourages resource
upgrading.

NATURAL GAS AND BY-PRODUCTS

Alberta's established natural gas reserves are estimated at 1,628 billion m³ which, at current rates, represents 18 years production. In addition, estimates of natural gas remaining to be discovered and developed total 1,600 billion m³. One of the major finds of this decade is the Caroline field, with an estimated reserve of 21 billion m³ of gas, 30.7 million m³ of natural gas liquids and 23 million tonnes of sulphur.

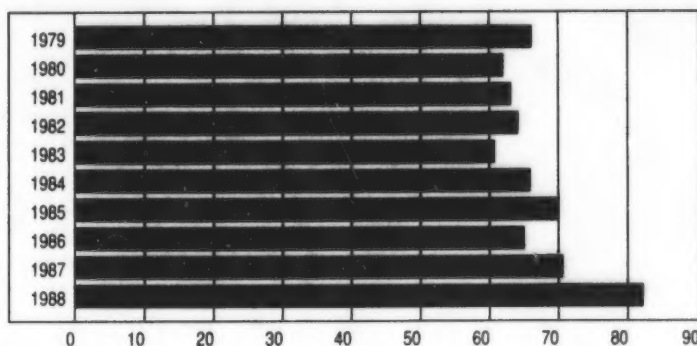
Alberta has more than 600 gas processing plants, with a capacity to process 450 million m³/d of raw gas. These units range in size from small plants, designed to conserve limited volumes of solution gas, to very large complexes which process raw gas from vast non-associated reservoirs and recover substantial amounts of sulphur.

Approximately 22 per cent of Alberta's natural gas production is consumed within the province - for space heating, industrial applications and petrochemical production. About 35 per cent is marketed elsewhere in Canada, primarily in Ontario, with Quebec a distant second. Exports to the U.S. - mainly California and the Midwest - account for 43 per cent of Alberta's production.

An extensive pipeline system carries Alberta natural gas to its various markets within Canada and the U.S. The NOVA Corporation of Alberta gathering system within Alberta carries almost all gas produced to four connecting pipelines: TransCanada PipeLines Limited (which carries virtually all gas to

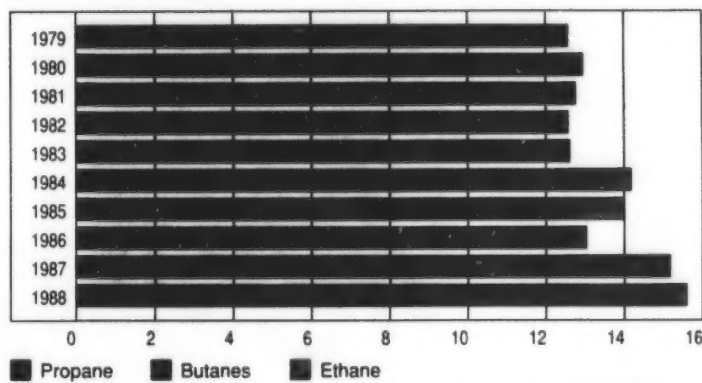
Gas Production

Billions of cubic metres



Natural Gas Liquids Production

Millions of cubic metres



the eastern provinces and to connecting U.S. pipelines); Foothills Pipe Lines Ltd. which goes to Midwest markets and the B.C.-U.S. border; Alberta Natural Gas Company Limited which carries gas to the B.C.-U.S. border; and Westcoast Transmission Company Limited which goes to the Pacific Northwest.

At present, increased gas exports from Alberta to the U.S. are limited by pipeline capacity, but numerous pipeline expansion projects have been proposed, with estimated capital costs in excess of \$10 billion.

PETROCHEMICALS

Drawing on its energy resources, Alberta has developed a world-class petrochemical industry that produces thousands of industrial and commercial products, including lubricants, plastics, detergents and dyes. The province's processing base includes two world-class ethane cracking plants, owned by Alberta Gas Ethylene Company Ltd.



Alberta ranks high in sulphur production.

Nine major chemical and fertilizer companies are located in Alberta, making the province Canada's largest petrochemical-producing area.

To date some \$6 billion has been invested in Alberta's

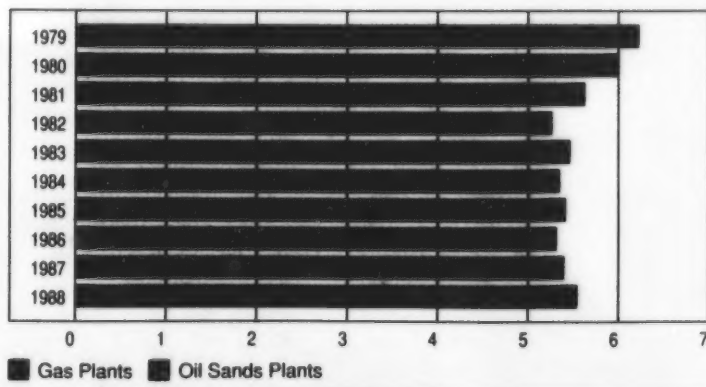
petrochemical, fertilizer and related facilities. These plants produce 1.5 million tonnes (or 60 per cent) of Canada's ethylene, 1.4 million tonnes (78 per cent) of its methanol and 2.6 million tonnes (68 per cent) of its ammonia. In 1988, Alberta's petrochemical production was valued at \$3.4 billion, making

this the province's second-largest manufacturing industry.

Alberta's petrochemical industry is export oriented, and elimination of tariffs and non-tariff barriers under the Canada/U.S. Free Trade Agreement is expected to significantly increase sales in the American market.

Sulphur Production

Millions of tonnes

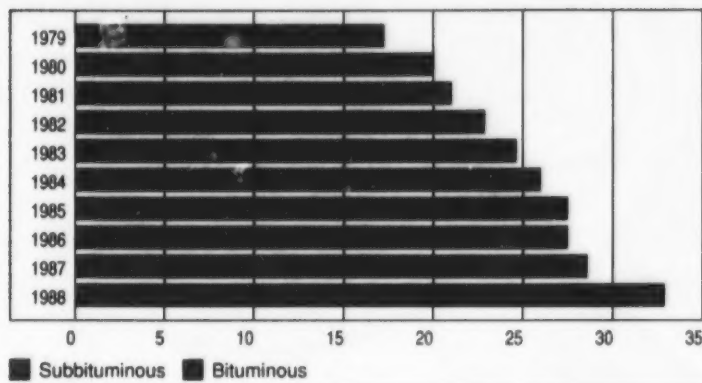


SULPHUR

Elemental sulphur, recovered as a by-product of natural gas and oil sands production, is of growing importance in the Alberta economy. The province has 55 sour gas processing plants and accounts for 45 per cent of the world's sulphur trade. Sulphur production from proven reserves now stands at 5.6 million tonnes per year.

Coal Mine Production (Raw Coal)

Millions of tonnes



COAL

The enormous coal resources found in Alberta total 79 billion tonnes, of which 32 billion are potentially recoverable. With nearly 60 per cent of Canada's coal reserves, Alberta is the largest producer and second largest exporter of coal.

The province's coal ranges from a subbituminous variety mined in the plains to high-volatile bituminous thermal coal in the foothills and low- and medium-volatile bituminous coking coal in the mountains. Small quantities of lignite also are found in the plains. Alberta's coal is clean burning and has a low sulphur content (ranging from 0.2 to 0.7 per cent).

Alberta produced 29.4 million tonnes of coal in 1988, of which 19.9 million tonnes (subbituminous) were used for electricity generation within the province, 1.9 million (bituminous thermal) were shipped elsewhere in Canada and 7.6 million (bituminous, metallurgical and thermal) were exported offshore, primarily to Japan and Korea.

ELECTRIC POWER

Alberta is the fifth largest producer of electricity in Canada, with a capacity of 6,600 megawatts. Of this total, 69 per cent comes from coal, 19 per cent from natural gas, and 12 per cent from hydro. Alberta's utility rates are among the lowest in the world.



INFRASTRUCTURE

Over the years Alberta has developed a solid infrastructure to serve the energy industry, including a superior highway and railway network and a sophisticated oil and gas pipeline system serving both local and external markets. The support system also includes a large number of service and supply companies (more than 16,000 in 1988), using the latest technology and drawing on the province's highly skilled workforce.

Alberta's primary steel, metals and machinery industry produces goods for the highly competitive energy equipment industry, with exports to more than 30 countries. This industry, working with manufacturers of construction materials, is preparing to meet the demands of such energy megaprojects as

Open pit mines are source of most Alberta coal.

OSLO. Also supporting the energy sector is Alberta's electronics industry, widely recognized for oil and gas field electronics, telecommunications equipment, and test measurement/control apparatus.

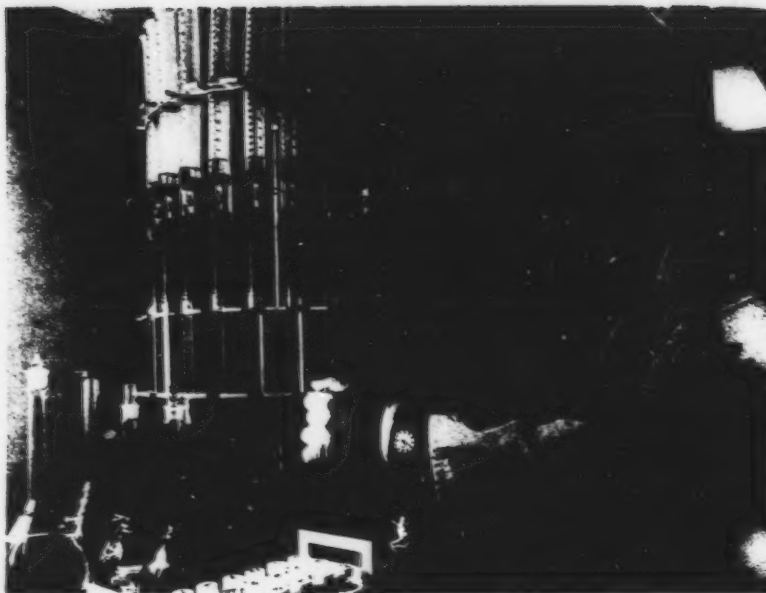
Four decades of energy development in Alberta have resulted in a highly industrialized and diverse energy economy.

RESEARCH AND DEVELOPMENT

Alberta is an acknowledged leader in research and development in the energy field, and technologies developed in the province are now competitively offered in world markets. Areas of Alberta expertise include oil sands and heavy oil research and development, in situ production techniques, directional and horizontal drilling, enhanced oil recovery and coal liquefaction. With extensive experience in the high Arctic, the Alberta oil and gas industry also has helped develop cold weather technology and products now used in other climates.

The provincial government and its agencies work closely with industry, universities, technical institutions and research organizations in developing new technology and transferring that technology to the marketplace.

The Alberta Oil Sands Technology and Research Authority has invested almost one-half billion dollars in oil sands/heavy oil research and development, and a number of technologies have been developed. At the Alberta Research Council, some \$16 million is spent annually on energy-related research.



Alberta is one of the few places in the world with an energy data base available to the private sector. At the Core Research Centre in Calgary, operated by the Energy Resources Conservation Board, industry geologists and others make extensive use of the 1.2 million metres of core and 9 million vials of drill cuttings submitted to the Board since its inception in 1938. A significant amount of geological information is also provided by the Alberta Geological Survey, a department of the Alberta Research Council.

The Alberta Office of Coal Research and Technology focuses the government's coal-related research and development activities. Canada's newest coal research centre was opened at Devon, Alberta in 1984, on the southwestern outskirts of Edmonton. About 120 researchers from the Alberta Research Council, the Canada Centre for Mineral and Energy Technology and the Coal Mining Research Company

Energy research has put Alberta in the forefront.

work there on a variety of challenges related to coal - exploration, mining, transportation, conversion.

The Centre for Frontier Engineering, currently being built in Edmonton's Research Park, is funded by governments, industry, universities and a private foundation and focuses on problems associated with the development of resources in the Arctic and offshore.

The Petroleum Industry Training Service has training facilities at Nisku, near Edmonton. The organization works with the energy industry, government and other industry groups to identify needs, develop and offer programs and to establish industry training standards.

These many research efforts underline Alberta's determination to stay in the forefront of energy technology in the 1990s and beyond.

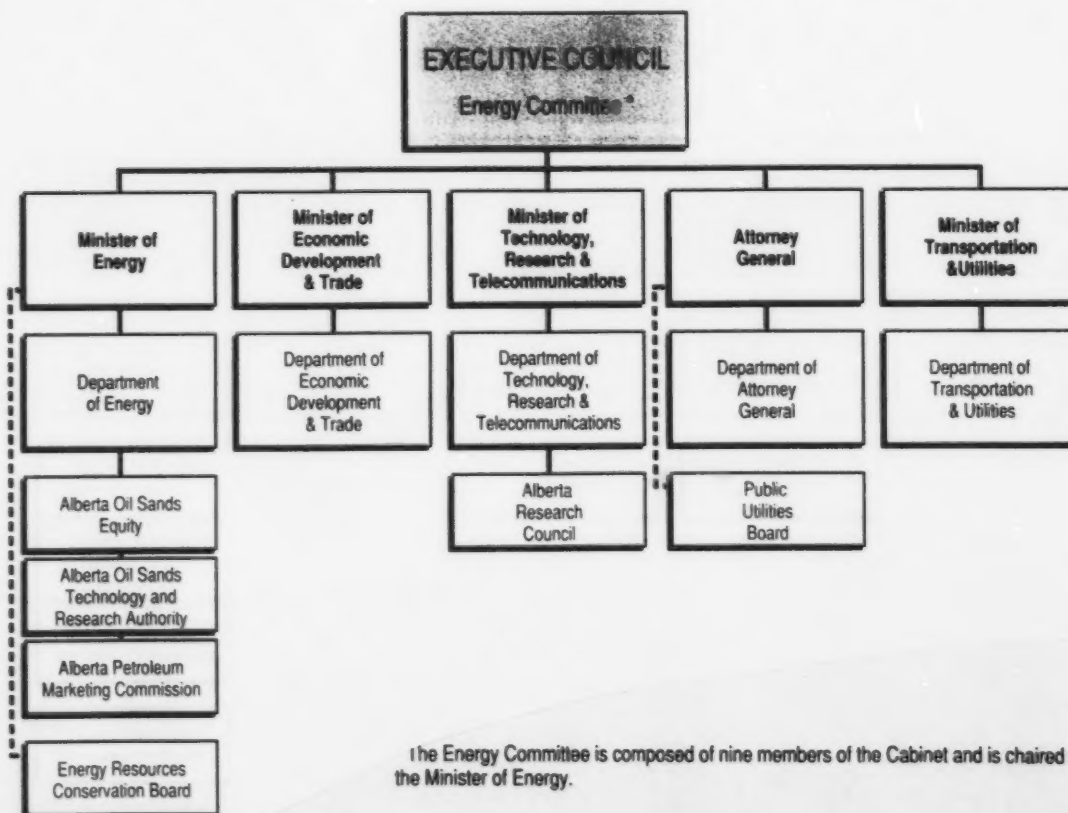
The Government of Alberta plays a unique role in managing Alberta's energy resources. By virtue of Canada's constitution and the common law system, the Government is owner of approximately 85 per cent of the mineral resources within provincial boundaries. In northern Alberta, where the oil sands are located, the Government owns 99 per cent of the resources. The remainder are owned "freehold" by private interests or by the federal government which owns the mineral rights in national parks and Indian reserves.

Canada is a federal state whose constitution apportions the

jurisdiction and responsibility for resources between the provinces and the federal government. Under the constitution, the provinces are granted primary legislative authority for resource management. This involves disposition of mineral rights, regulation of exploration and production, determination of conservation practices, development of environmental policies and standards, establishment and collection of fair returns from resources, and regulation of the transportation of resources within provincial boundaries.

As owner and regulator, the Government of Alberta is guided by a number of resource management principles:

- **Private sector development** - While the Government owns most of the resources, it leases the mineral rights to the private sector for development, with Government continuing to play a key role in research and development and infrastructure development.
- **Market-Oriented Policies** - The Government believes that the market is the best allocator of resources and it has strongly advocated and supported the deregulation of



The Energy Committee is composed of nine members of the Cabinet and is chaired by the Minister of Energy.

crude oil and natural gas pricing and marketing. In addition, the Alberta Government strongly supports free trade and the Free Trade Agreement with the United States of America.

- **Fair Share of Resource Rents** - On behalf of the people of Alberta, the Government collects a fair share from resource development through royalties, fees, and a freehold mineral tax.

The policies, legislation and regulations of the Government are developed and administered by a number of departments and agencies, chief of which are the Department of Energy, the Energy Resources Conservation Board, the Alberta Petroleum Marketing Commission, the Alberta Oil Sands Technology and Research Authority, the Alberta Research Council, the Department of Economic Development and Trade, Alberta Oil Sands Equity, the Department of Transportation and Utilities and the Public Utilities Board.

THE DEPARTMENT OF ENERGY

This Department plays a vital role in managing Alberta's substantial energy resources for the benefit of Albertans. It performs four basic functions:

- it disposes of mineral rights and administers mineral agreements on behalf of the Crown;
- it provides policy recommendations and advice on energy to the government;
- it advises on, establishes and administers the fiscal regimes and royalty system through



which the government obtains its fair share of Alberta's resources (including the negotiation of fiscal and royalty regimes for the major energy projects); and

- it administers energy-related research, development and conservation programs.

The Department is organized along divisional lines. The five main divisions are:

- **Mineral Resources Division** handles the sale of available mineral rights, administers existing mineral agreements which have been leased for a specific period and manages the Crown's mineral rights, covering petroleum and natural gas, coal, oil sands, industrial and metallic minerals, placer minerals and salts. It ensure that non-renewable resource

Pipeline network carries oil and gas to expanding markets.

exploration and development are encouraged, when they are in the public interest.

- **Policy Analysis and Planning Division** is responsible for analysis of oil and gas markets, assessment of regulatory and legislative issues, energy prices and demand forecasts, and assessment and reports on industry. It communicates the importance of energy resources and government energy programs to the public and promotes energy efficiency and conservation.
- **Projects and Supply Development Division** is responsible for financial and technical evaluation of oil sands and upgrading projects and for economic evaluation

and analysis of the costs of finding and developing conventional oil, gas and coal. It is responsible for long- and short-term strategic planning to determine the economic and technical feasibility of development projects in Alberta's oil and gas industries, oil sands, and coal fields. It advises on the appropriate government involvement or investment in each project and recommends a specific fiscal treatment of royalties, taxes, grants and incentives.

- **Mineral Revenues Division** works to ensure the best possible compensation for the resources wherever the Crown owns mineral rights. It administers a number of incentive programs which enhance the exploration for and extraction of minerals in Alberta. The division is responsible for calculating, collecting and verifying royalties paid for mineral extraction.
- **Scientific and Engineering Services and Research Division** manages and channels the federal and provincial government's funding within the province for research and development of sources of energy other than oil. It also provides technical advice and support to the Department.

ENERGY RESOURCES CONSERVATION BOARD

The Energy Resources Conservation Board (ERCB) is a quasi-judicial regulatory body charged with promoting and overseeing the safe, efficient and



environmentally sound development of provincial energy resources. The Board, formed in 1938, has regulatory responsibility for all phases of development involving oil, gas, oil sands, coal and electric energy in the province. It also regulates pipelines and electricity transmission lines, as well as large industrial users of energy in Alberta.

Based in Calgary, with a staff of more than 700, the Board has become a recognized world leader in the technologies of oil and gas conservation, including enhanced oil recovery, reservoir pressure maintenance techniques, and solution gas recovery. It maintains an extensive information data base on all provincial energy resources. Additionally, the Board's Core Research Centre, located in the University of Calgary's Research Park, operates on the front line in this important field.

All new energy projects proposed in Alberta, plus any significant changes proposed to existing energy facilities, must be approved by the Board before work may begin. As a rule, the

Development in harmony with the environment is a major goal.

Board must review and approve the technical, environmental, social and economic merits of such projects before final approval will be given.

Because of Alberta's strict developmental and environmental standards, plus the inspections and monitoring carried out in the field, the province has benefited from many years of significant energy development with only minor negative impacts on its environment. The key to this inspection and monitoring work is the Board's 100-person field inspection team, based in eight strategically located offices. Their inspections focus on such matters as safety and environmental factors, as well as on production surveillance.

The Board's legislated mandate provides for calling public hearings should citizens directly affected by specific energy projects express concerns regarding a company's proposal. In most instances, the Board's decisions are reached independently, but in some cases

- particularly in connection with complicated major projects - its recommendations must be ratified by the Alberta Government.

An unusual feature of the Board is that its operating budget is derived equally from the industry being regulated (mainly through an administrative levy on producing oil and gas wells in the province) and from the Alberta Government, which establishes the regulations.

ALBERTA PETROLEUM MARKETING COMMISSION

The Alberta Petroleum Marketing Commission's mandate is to ensure the government secures the greatest benefits possible from the sale of the province's crude oil and natural gas.

In addition to carrying out administrative, marketing, research and regulatory activities, the Calgary-based Commission provides policy advice to the Alberta government on marketing issues. It operates under the authority of the Petroleum Marketing Act, the Natural Gas Marketing Act and the Take-or-Pay Costs Sharing Act.

The Commission sells the Crown's share of conventional crude oil production obtained through royalties and the province's ownership and royalty share of synthetic crude oil produced by Syncrude Canada Ltd. It also purchases and markets crude oil as an optional service to producers. As a result, the Commission is the highest volume seller of crude oil in Canada.

Among its natural gas-related responsibilities, the Commission collects and analyzes information on natural gas prices and markets in order to establish royalty levels and verify royalty payments. It issues findings of producer support for netback pricing arrangements and, relative to these arrangements, provides services to producers and shippers in verifying revenue and cost components. The levies charged to users of the TransCanada PipeLines Limited system, to ensure the sharing of take-or-pay costs, are determined and administered by the Commission.

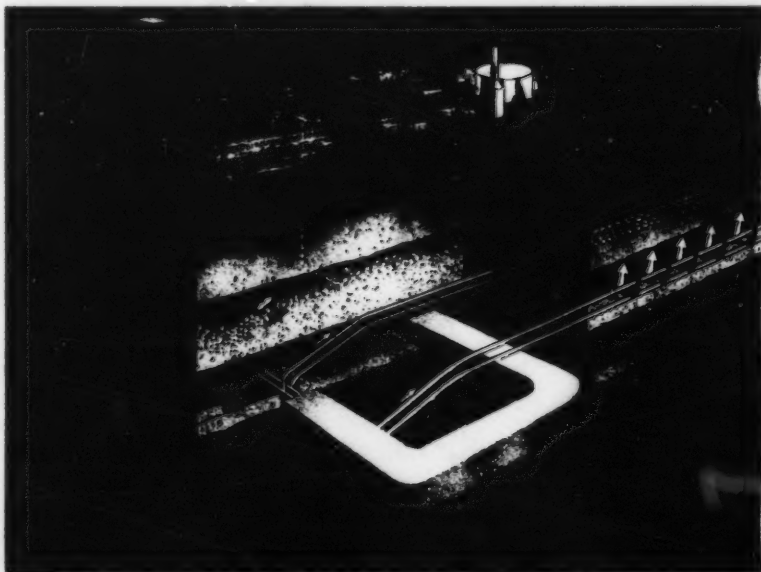
The Commission represents the interests of the Alberta government in regulatory proceedings in Canada and the U.S. when issues under consideration have the potential for impact on the market value of Alberta-produced crude oil and natural gas.

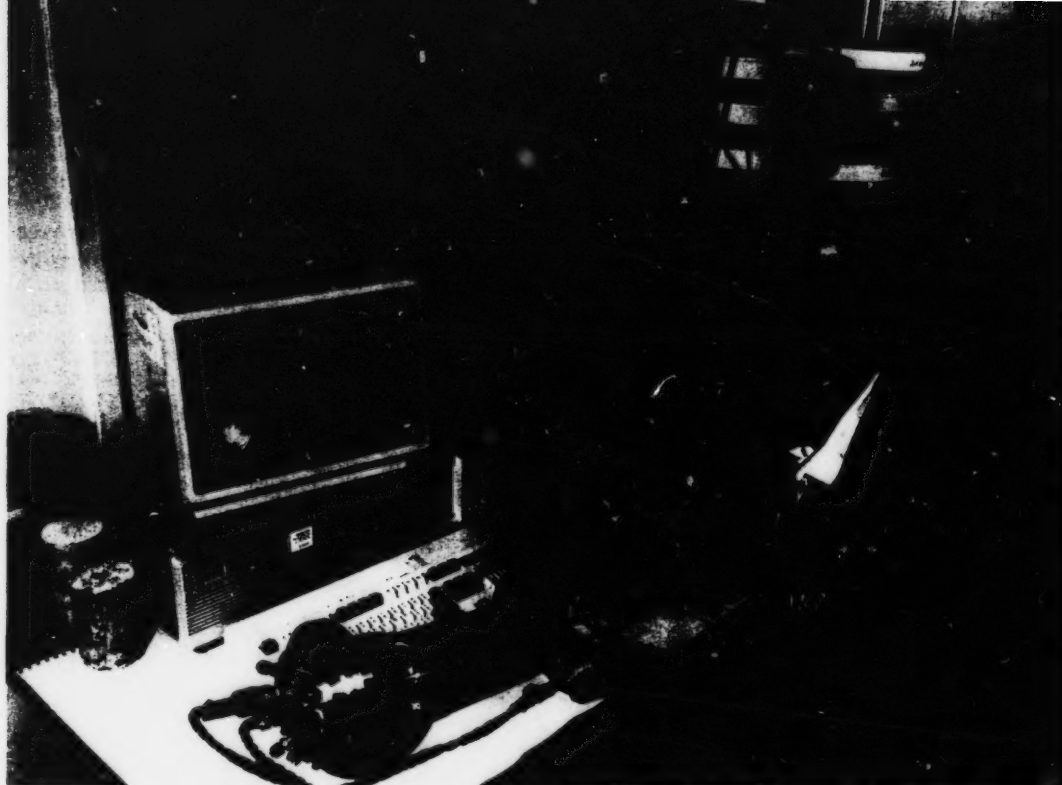
Underground Test Facility: new approach to bitumen recovery.

ALBERTA OIL SANDS TECHNOLOGY AND RESEARCH AUTHORITY

The Alberta Oil Sands Technology and Research Authority (AOSTRA), a provincial Crown corporation established in 1974, spearheads Alberta government participation in oil sands and heavy oil research. Its mandate is to develop technology for the efficient and economic recovery and processing of bitumen, heavy oil and crude oil. The technology must be environmentally acceptable and readily transferable to industry and to other nations.

Over the past 15 years AOSTRA has invested about \$.5 billion in research and development, with a similar amount being invested by industry. This has resulted in the development of a \$1 billion pool of technology which is available, under suitable





licensing arrangements, to organizations and governments around the world.

The largest part of AOSTRA's funding goes to cost-shared projects (with industry) in such areas as field tests of production processes and pilot-scale tests of new bitumen extraction and upgrading processes. Two of AOSTRA's field pilots have become commercial in situ recovery operations.

In the Athabasca oil sands near Fort McMurray, AOSTRA operates the Underground Test Facility (UTF), an innovative in situ oil sands recovery pilot plant. Here, studies focus on recovery of bitumen from oil sands using steam in horizontal wells drilled from a shaft and tunnel system.

AOSTRA receives research proposals from companies, universities, governments and individuals, and each is reviewed by an appointed board. Of the 800 applications received since 1975, more than 200 have been accepted for funding.

Numerous technology exchange agreements have been signed with interested foreign organizations and have often led to trade between Alberta and other countries in the petroleum equipment, engineering and service industries. AOSTRA's funding generates a constant level of research in the province and its encouragement of co-operative efforts has allowed companies that otherwise may not have been able to conduct research into important new developments.

ALBERTA RESEARCH COUNCIL

The Alberta Research Council is a Crown corporation which was established in the early 1920s to promote, support and direct scientific research and development in the province.

The Research Council and its more than 550 employees support industry and

Technology developed for world markets.

government through a wide range of research in science and technology as applied to energy, mineral resources, agriculture, forestry, environment, industrial assistance and new technologies. The Alberta Research Council's headquarters are in Edmonton, with branch offices in Calgary and four other centres.

Three of the Research Council's 10 research departments are specifically devoted to research and development in energy, but others become involved due to the organization's integrated, multidisciplinary efforts. The key energy departments are the Alberta Geological Survey, the Coal and Hydrocarbon Processing Department and the Oil Sands and Hydrocarbon Recovery Department.

The Alberta Geological Survey's role includes research, geological characterization and assessment of the province's earth resources; examination of environmental problems

associated with deep waste disposal; and providing technical and geoscientific information for government, industry and the public. Current research focuses on the distribution and variability of coal quality in Alberta's plains and foothills and the development of a coal geology data base.

The Coal and Hydrocarbon Processing Department explores technologies to improve the commercial qualities of coal, bitumen and heavy oil. Research which reaches the demonstration stage is client-funded, cost-shared or supported by government investment. The Coal Research Centre, located southwest of Edmonton, houses a full range of analytical

Research scientists: projects for industry and government.

equipment used in the design and construction of on-site pilot plants. A High Pressure Test Facility is located nearby. Key research involves coal utilization and quality, and hydrocarbon upgrading to improve product yields and raise the quality of synthetic crude to refinery specifications.

The Oils Sands and Hydrocarbon Recovery Department has developed world-class technology and expertise through its continuing research in oil recovery and production. Studies concentrate on methods of bitumen and heavy oil recovery in an effort to improve the efficiency and economy of recovery methods. Department engineers, scientists and technologists conduct research and development projects for industry and government agencies on a contract basis. Complete in-

house research services are maintained, including analytical research and testing services and a sample bank.

DEPARTMENT OF ECONOMIC DEVELOPMENT AND TRADE

Alberta Economic Development and Trade acts as a catalyst for the province's economic growth and diversification.

The Government of Alberta recognizes Alberta's responsibility as a member of the world community and the Economic Development and Trade Department plays the lead role in responding to new business opportunities and challenges within Canada and around the world. The spirit of



teamwork between private enterprise and government is demonstrated by the department's work with Alberta's entrepreneurs and business leaders.

The department emphasizes incoming and outgoing trade missions to open and expand markets in key regions of the United States, in Europe and in the Asia/Pacific sector. In penetrating competitive international markets, Alberta's multicultural population is a valuable resource.

The Trade and Investment Division is mainly responsible for dealing with other countries. It assists and encourages Alberta businesses to participate effectively in expanding export markets and attracting investment. The division works with companies to identify and gain access to new export markets. Special attention is given to those Alberta companies that produce products, technologies and services which are competitively priced or which have a comparative advantage. Assistance is also given to companies which produce products and services particularly suited to conditions indigenous to the marketplace or to the need of a certain country or region. Trade activities include ministerial trade missions, seminars and trade shows. All of this is designed to match business opportunities to the capabilities and expertise of Alberta's private sector.

At the same time, the division works with clients from around the world, putting them in touch with Alberta businesses for the purpose of trade and investment. Complementing the Trade and Investment Division are the Small Business and Industry Division which encourages

business development in Alberta, and the Policy and Planning Division which identifies issues, formulates provincial policies and sets new directions in international, bilateral and interprovincial trade and transportation.

ALBERTA OIL SANDS EQUITY

Alberta Oil Sands Equity (AOSE), an unincorporated agency reporting to the Minister of Energy, manages the government's investment in three major energy projects: Syncrude and the Other Six Leases Operation (OSLO), both located in the Athabasca oil sands near Fort McMurray, and the Bi-Provincial Upgrader project near Lloydminster.

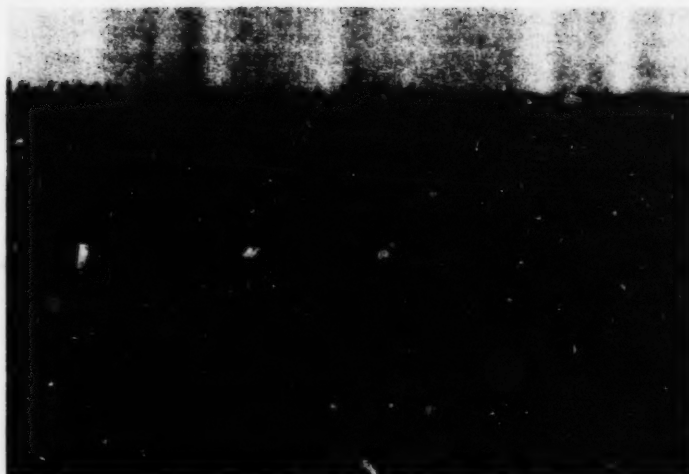
Alberta's equity investment in Syncrude began in 1975 following withdrawal of a major industry participant. Edmonton-based AOSE was established to manage this 16.74 per cent investment through representation on Syncrude owner committees and task forces involved in making decisions and setting overall

Overburden removal at an oil sands plant.

policy for Syncrude Canada Ltd. By March 31, 1989, Alberta's participation in this project amounted to \$511.9 million, consisting of net cash advanced of \$98.8 million and accumulated revenue of \$413.1 million. At present, the Alberta Oil Sands Equity chairman is chairman of the board of directors of Syncrude Canada Ltd.

AOSE's involvement in OSLO began when Alberta became a Syncrude participant. As part of its Syncrude investment, Alberta acquired a 10 per cent interest in six oil sands leases in addition to the two which were already part of the Syncrude project.

In 1981 an operating agreement was signed by the OSLO owners to provide for an exploration and development program on the Other Six Leases. In September 1988, the six OSLO participants and the governments of Alberta and Canada signed an agreement which is expected to result in the construction of a \$4.1 billion, fully-integrated oil sands mining project northeast of the Syncrude site. The plant is



expected to be operational by 1996, producing 12,500 m³ of synthetic crude oil a day. The plant will utilize similar technologies and build upon successes from the Syncrude Project.

The OSLO consortium will also continue to develop new lower cost technologies, such as dredging and borehole mining, and a bitumen extraction process called OSLO Cold Water Extraction which utilizes significantly less heat and incorporates a slurry transportation pipeline. As with Syncrude, Alberta Oil Sands Equity manages the investment in both the OSLO Commercial Project and the New Technology Program, through representation on OSLO owner committees and task forces which make decisions and set overall policy for the projects.

The Chairman of Alberta Oil Sands Equity is the Alberta Government's representative on the Lloydminster Bi-Provincial Upgrader Joint Venture Board, which has overall authority and responsibility to manage the business and affairs of the joint venture. The Bi-Provincial Upgrader is a joint venture project of the Governments of Alberta, Saskatchewan and Canada, and Husky Oil Ltd. The \$1.267 billion project was announced in September 1988, with production startup scheduled for 1992. The plant will have production of approximately 7,300 m³ a day of high quality synthetic crude oil from heavy oil and bitumen feedstock.

Province boasts world-class refineries.

PUBLIC UTILITIES BOARD

This Board is an independent provincial agency whose primary responsibility is to ensure that customers of regulated utilities operating in Alberta receive safe and adequate service at just and reasonable rates. In so doing, the Board must balance the needs of both the customers and investors in those utilities.

The Board establishes the rates and services regulations for all regulated utilities in the province through an open public hearing process. Any proposed changes to a utility's rates or regulations must be addressed in public hearings.

The Board may, subject to or on the authorization of the Lieutenant Government in Council, fix charges relating to the processing of natural gas at gas processing plants.

ALBERTA TRANSPORTATION AND UTILITIES

Alberta Transportation and Utilities plays an important role in facilitating the provision of natural gas and electric utility services to Albertans, particularly those in agricultural and remote areas of the province. In Alberta, natural gas and electric utility services are provided by a mix of investor-owned utility companies, municipally owned utilities and rural co-operatives.

The Rural Gas Program provides capital grant assistance, technical and other advice to utilities and co-operatives for the extension of natural gas distribution systems in rural areas. This program has made natural gas available and affordable throughout rural and agricultural areas and approximately 90 per cent of Alberta households have the



service today. The Rural Electrification Program, established in the 1940s, offers loans to help reduce capital costs for farm electrical installations.

The Department also provides government with policy analysis and advice on the utilities industry, including development of the framework by which the Energy Resources Conservation Board and the Public Utilities Board deal with utility production and rate matters.

Recently, the Small Power Research and Development Act was introduced to help encourage electricity generation by small power producers using renewable wind, hydro and biomass resources. These producers sell electricity to utilities at an incentive price based on future utility avoided cost. The Act will be in effect for five years and pricing and other small power policies will then be reviewed for the longer term.

INTERNATIONAL ACTIVITIES

Under Canada's constitution the federal government has primary responsibility for international relations. Most of Alberta's international interests are therefore represented through normal diplomatic channels. The constitution nevertheless provides flexibility and allows the provinces to assume limited authority for conducting international relations.

Historically, the provinces have maintained agents general in London since Canada was established as a nation in 1867.

The Government of Alberta and its agencies are involved in international activities in several ways. The province plays a role

in the formulation of Canada's external policy and is actively involved in domestic mechanisms for aggregating the various interests.

In collaboration with the federal government, the province maintains a close rapport with international agencies. In this connection Alberta has participated on several committees of the International Energy Agency.

Through the Alberta Department of Federal and Intergovernmental Affairs, the province maintains six offices in key centres around the globe - London, Tokyo, Seoul, Hong Kong, Los Angeles and New York. These offices monitor and assess developments of significance to Alberta; facilitate contact with foreign governments and business interests; promote investment and interest in Alberta; and promote and facilitate the trade of Alberta goods and services.

The Government and its agencies are directly involved in a variety of programs, agreements, exchanges and ongoing missions. These energy-related activities are summarized below.

AOSTRA was one of the founding members of the United Nations Information Centre for Heavy Crude and Tar Sands and played host to the 4th International Conference on Heavy Crude and Tar Sands in Edmonton in 1988.

The Authority also carries out projects and/or exchanges with agencies in China, the Soviet Union, Czechoslovakia, the Federal Republic of Germany, Japan, Brazil and other countries, and has signed Memoranda of Understanding or Letters of Co-operation with the

Venezuelan Technological Institute of Petroleum, the Cuban Oil Trust, the Hungarian Hydrocarbon Institute, ROMPETROL-GEOMIN of Romania and the Turkish Petroleum Corporation.

Through several departments and agencies, the province supports the Alberta Summer Institute for Petroleum Industry Development in Edmonton. This institute offers an annual two-month training program at the University of Alberta for petroleum personnel from around the world.

Over the years, the ERCB has welcomed trainees from many countries, providing expertise on energy industry regulation and development standards. One member of the board was given a two-year leave of absence to advise Kuwait on petroleum and natural gas conservation programs.

The Alberta Research Council also participates in international work. In 1989 it concluded a year-long study in Indonesia on the feasibility of using that country's oil sands to make asphalt.

Activities relating to coal include participation by the Alberta Office of Coal Research and Technology in the International Energy Agency Agreement on Coal.

This brief summary of some of Alberta's international activities in the energy field carries a clear message: Canada's energy province is prepared and willing to share in the ever-growing exchange of technology and ideas with the rest of the world.

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